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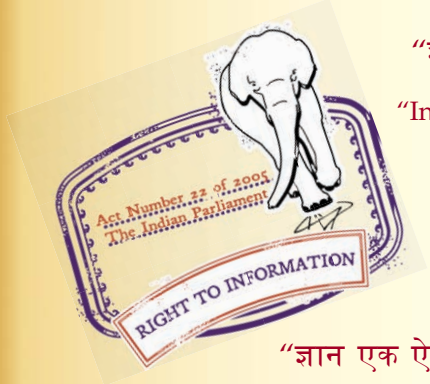

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Indian Standard

CODE OF PRACTICE FOR USE OF RESIN TYPE CHEMICAL RESISTANT MORTARS

(First Revision)

UDC 691.53 : 666.971.019.34 : 69.001.3

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 1980

Indian Standard

CODE OF PRACTICE FOR USE OF RESIN TYPE CHEMICAL RESISTANT MORTARS

(First Revision)

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AMENDMENT NO. 1 JULY 1992
TO
IS 4443 : 1980 CODE OF PRACTICE FOR USE OF RESIN TYPE CHEMICAL RESISTANT MORTARS

(First Revision)

(*Page* 6, *clause* 8.1.1) — Substitute 'IS 158 : 1981‡' *for* 'IS : 3384 - 1965‡' and 'IS 9510 : 1980§' *for* 'IS 1580-1968§.'

(*Page* 6, *foot-notes marked with* '‡' *and* '§' *marks*) — Substitute the following for the existing foot-notes:

‡ Specification for bitumen primer for use in water-proofing and damp-proofing (*first revision*)

§ Specification for bitumen mastic, acid-resisting grade.'

(CED 5)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CODE OF PRACTICE FOR USE OF RESIN TYPE CHEMICAL RESISTANT MORTARS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 29 February 1980, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The choice of an appropriate chemical resistant mortar for use in construction as a bonding material requires adequate consideration. A particular type of mortar which may be suitable for a particular environment may be completely unsuitable for another. Hence the selection of a bonding material has to be entirely based on the specific problem at hand. The resin mortars have fairly good resistance to non-oxidizing mineral acids but have poor resistance to oxidizing mineral acids. They are fairly resistant to inorganic alkalies. Where conditions are questionable, specific recommendations should be obtained from the manufacturer. The requirements for resin type mortar are covered in IS : 4832 (Part II)-1969*.

0.3 This standard which was first published in 1967 is intended to provide guidance for use of resin type chemical resistant mortars. The present revision is taken up mainly to incorporate the modifications necessary as a result of experience gained by the industry in the manufacture and use of such type of mortars. In this revision the method of application of resin type mortars has been reviewed and updated to bring them in line with the existing practice being followed in the country. The application of such mortars both on walls and floors has been laid down separately. Such detail has become particularly significant in view of the development made by the industry. With regard to the joint thickness between masonry units, the provision has been modified.

*Specification for chemical resistant mortars : Part II Resin type.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down recommendations for the storage, mixing, method of use and safety precautions required in handling resin type chemical resistant mortars.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Resin Type Chemical Resistant Mortar — An intimate mixture of liquid resinous material and a powder composed of properly selected filler materials and usually containing the setting agent. These components are mixed at ordinary temperatures to form a trowelable mortar that subsequently hardens.

3. STORAGE

3.1 The resins shall be stored in a clean dry place away from open flame and under a roof with containers tightly closed. The resins could generally be stored without deterioration at 27 ± 2°C for periods not exceeding the values given below. The filler or resin that has become wet shall not be used:

Type of Resin	*Storage Period in Months*
i) Cashew-nut shell liquid	9
ii) Epoxy	12
iii) Furane	12
iv) Phenolic	3
v) Polyester	3

*Rules for rounding off numerical values (*revised*).

NOTE — The storage periods may be increased or decreased in consultation with the manufacturer.

4. SAFETY PRECAUTIONS

4.1 Both the liquid and the powder ingredients may contain materials that may affect the skin. Therefore, either gloves or barrier cream shall be used while handling these materials.

4.2 Vapours are present in most of the resin mortars and some produce gases during cure. Adequate ventilation shall be provided in the mixing and working areas. Under confined areas like vessel lining, etc, forced air draught may be used.

4.3 Resin mortars that are labelled as inflammable by the manufacturer shall be used with adequate safety precautions against fire.

4.4 Solvents used for cleaning tools are generally inflammable. Fires shall be kept away from the area in which such solvents are used and 'NO SMOKING' sign shall be pasted in these areas.

5. EQUIPMENT

5.0 All equipment shall be kept clean and dry.

5.1 Shallow basin of enamel or polyethylene may be used for hand-mixing.

5.2 As curing of resin type mortars is accompanied by exothermic reactions, cooling is often necessary in hot weather. Furane type of resins may be cooled by immersing the container in ice water. Epoxy and polyester resins may be cooled in a container immersed in water at ambient temperature to avoid condensation of moisture below dew point.

6. MIXING

6.1 For hand-mixing required quantity of the liquid resin shall be poured into the basin. The powder shall then be added gradually and the mixture shall be well stirred, working out all lumps and air bubbles. The mortar shall be mixed to the proportion as specified by the manufacturer for a particular type of job. A stainless steel spatula may be used for mixing purposes.

6.2 Only such quantity of mortar that could be consumed within 15 to 20 minutes shall be prepared unless otherwise recommended by the manufacturer.

7. HANDLING

7.1 Resin mortars cure slowly at low temperatures. If the work is to be carried out at temperature below 15°C, masonry units should be warmed and the area of work shall be enclosed and heated to above 15°C by using infra red lamp, to obtain proper curing.

7.2 Mixed mortar that has become unworkable shall not be retempered with liquid resin, but shall be discarded.

8. APPLICATION

8.1 Surface Preparation — The surface on which chemically resistant bricks conforming to IS : 4860-1968* or tiles conforming to IS : 4457-1967† are to be laid, shall be free from dirt and dampness and shall be properly cured and dried.

8.1.1 *Application of Membrane* — The surface after preparation shall be applied with a coat of bitumen primer conforming to IS : 3384-1965‡. The primed surface shall be subsequently applied with a uniform coat of bitumen conforming to IS : 1580-1969 §. If the bedding material is epoxy or polyester resin, the tiles or bricks can be laid directly on to the surfaces without application of bitumen primer. In case of furane, cashewnut shell liquid and phenolic type resin, a coat of bitumen primer conforming to IS : 3384-1965‡ shall be used subject to service conditions. Other membranes such as rubber, lead, polyisobutane, and fibre-reinforced plastics can also be used in place of bitumen primer.

8.2 Mortar Application with Same Bedding and Jointing Materials

8.2.1 *On Floors* — Spread the resin type mortar 6 to 8 mm thick on the back of the tile or brick. Smear two adjacent sides of the tile or brick with 4 to 6 mm thick mortar. Press the tile or brick into the bed and push against the floor and the tile or brick until the joint in each case is 2 to 3 mm thick. Trim off excess mortar and allow it to harden fully. Cure with acid as given in **8.4** except for epoxy and polyester resins.

---

*Specification for acid-resistant bricks.

†Specification for ceramic unglazed vitreous acid-resistant tiles.

‡Specification for bitumen primer for use in waterproofing and damp-proofing.

§Specification for bituminous compounds for water proofing and caulking purposes (*first revision*).

8.2.2 *On Walls* — Spread the resin type mortar 6 to 8 mm thick on the back of the tile or brick. Smear two adjacent sides of the tile or brick with 4 to 6 mm thick mortar. Press the tile or brick against the wall and with the adjacent tile or brick until the joint in each case is 2 to 3 mm thick. Trim off excess mortar and allow it to harden fully. While carrying out the jointing, allow sufficient time to avoid the joints at the bottom getting disturbed and the tile or brick getting slided. Only one course of tile or brick shall be laid during the initial setting. Cure with acid as given in **8.4** except for epoxy and polyester resin.

8.3 Mortar Application with Different Bedding and Jointing Materials

8.3.1 *On Floors* — Spread on to the back and two adjacent sides of the tile or brick the silicate type mortar 6 to 8 mm thick. Press the tile or brick on the bed and push against the floor and the tile or brick, until the joint in each case is 3 to 6 mm thick maintained by employing spacers. Before the silicate mortar sets completely, the jointing material is removed to a depth of 20 mm. The material thus removed, may be used for bedding provided it is trowelable and has not hardened. After the bedding mortar is properly set, cure the joints as given in **8.4** and fill the joints full with resin type mortar taking special care to fill up the entire length of the joint. Trim off excess mortar to make the joints smooth and plane.

8.3.2 *On Walls* — Spread on to the back and two adjacent sides of the tile or brick the silicate type mortar 6 to 8 mm thick. Press the tile or brick against the wall and with the adjacent tile or brick until the joint in each case is 3 to 6 mm thick maintained by employing spacers. Only one course of tile or brick shall be laid during the initial setting time to avoid the joints at the bottom getting disturbed and the tile or brick getting slided. Before the silicate mortar sets completely, the jointing material shall be removed to a depth of 20 mm. The material thus removed may be used for bedding provided it is trowelable and has not hardened. After the bedding mortar has properly set, cure the joints as given in **8.4** and fill the joints full with resin type mortar taking care to fill the entire length of the joint. Trim off the excess mortar to make the joints smooth and plane.

8.4 Acid Curing — Except for epoxy and polyester resins, cure the joints for a minimum period of 72 hours with 20 to 25 percent hydrochloric acid or with 30 to 40 percent sulphuric acid before applying the resin type mortars. After acid curing, wash the free acid in the joints with clean water and allow sufficient time for thorough drying. Resin mortars shall then be filled into the joints.

9. CLEANING

9.1 Cleaning Mortar From Brick or Tile — Various compounds are available for masking masonry units to prevent mortar from adhering to them. Such compounds may be removed by steam or water after the joints have hardened.

9.1.1 The manufacturer of the mortar should be consulted for the method of cleaning mortar from the face of the masonry unit before hardening, since the cure of certain mortars is affected by contact with water.

9.2 Cleaning the Equipment — Equipment should be cleaned frequently with solvent mixtures containing ketones, such as acetone, or with the solvent as recommended by the manufacturer. Hardened mortars may be removed from metal equipment by burning.

9.3 Cleaning of Hands — Resin mortar adhering to the hands or skin of the operator shall be wiped off with a cotton waste and the region washed with warm soap water or with special cleansing creams. Solvents used for cleaning equipment shall not be used for cleaning hands.

10. CURING

10.1 Resin mortars are normally self-curing and do not generally require any auxiliary curing. They should not be put to use before 48 hours in the case of furane, epoxy and polyester resin type mortars. They may be put to use after 48 hours provided the setting temperature is at least 20°C. In the case of phenolic and cashewnut shell liquid resin and for lower temperatures the period of curing shall be extended as recommended by the manufacturer. Without any heat treatment the phenolic resin and the cashewnut shell liquid resin shall not be put to use for 7 to 28 days respectively. With heat treatment the phenolic and the cashewnut shell liquid resin may be put to use after 2 and 6 days respectively. The construction shall be protected from weather and water and from accidental mechanical damage until the mortar is cured.

NOTE — Heat treatment may be given with infra red lamp.

11. CHEMICAL RESISTANCE OF RESIN TYPE MORTARS

11.1 A general guide for chemical resistance of resin type mortars to various substances is given in Table 1. The ratings are for immersion service at ambient temperature and may be upgraded for spillage only. Specific recommendations should be obtained from the manufacturer where conditions are questionable.

TABLE 1 CHEMICAL RESISTANCE OF RESIN TYPE MORTARS

(*Clause* 11.1)

Sl No.	Substance	Epoxy	Polyester	Phenolic	Furane	Cashew-nut Shell Liquid
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Acids :					
i)	Acetic acid 10%	R	R	R	R	R
ii)	Chromic acid 10%	N	R	L	N	L
iii)	Hydrochloric acid (conc)	R	R	R	R	R
iv)	Hydroflouric acid 40% (*see* Note 2)	N	N	R	R	R
v)	Lactic acid 2%	R	R	R	R	R
vi)	Nitric acid 10%	L	N	L	N	L
vii)	Nitric acid (conc)	N	N	N	N	N
viii)	Phosphoric acid 10%	R	R	R	R	R
ix)	Sulphuric acid 10%	R	R	R	R	R
x)	Sulphuric acid 40%	R	R	R	R	R
xi)	Sulphuric acid (conc)	N	N	L	N	N
	Alkalies :					
i)	Ammonia 0·880	R	N	L	R	R
ii)	Sodium hydroxide 40%	R	N	L	R	L
iii)	Sodium carbonate	R	L	R	R	R
iv)	Calcium hydroxide	R	N	R	R	R
	Salt Solutions :					
i)	Salt solution (acidic)	R	R	R	R	R
ii)	Salt solution (alkaline)	R	L	R	R	R
	Solvents :					
i)	Aliphatic hydrocarbons	R	R	R	R	N
ii)	Aromatic hydrocarbons	L	N	R	R	N
iii)	Alcohols	R	R	R	R	R
iv)	Ketones	L	N	L	R	R
v)	Chlorinated hydrocarbons	L	L	R	R	N
	Wet Gases (oxidizing)	N	N	N	N	N
	Wet Gases (reducing)	R	R	R	R	R
	Mineral Oils	R	R	R	R	L
	Vegetable Oils and Fats	R	R	R	R	L

Note 1 — R = Generally recommended,
L = Limited use (occasional spillage), and
N = Not recommended.

Note 2 — Carbon and graphite fillers should be used for hydroflouric acid service.

12. DRY HEAT LIMITS

12.1 A general guide for the use of resin type mortars at elevated temperatures is given at Table 2. The ratings are for dry heat in air only.

TABLE 2 DRY HEAT LIMITS IN AIR OF RESIN TYPE MORTARS

Sl No.	Type of Resin	Dry Heat, *Max* °C
(1)	(2)	(3)
i)	Phenolic	150
ii)	Furane	150
iii)	Epoxy:	
	a) Ambient temperature system	90
	b) Heat-cured system	200
iv)	Polyester	110-120
v)	Cashewnut shell liquid resin	170-180

(*Continued from page* 2)

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653-1962 Sheet linoleum (*revised*)
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658-1962 Code of practice for magnesium oxychloride composition floors (*revised*)
809-1970 Rubber flooring materials for general purposes (*first revision*)
1195-1978 Bitumen mastic for flooring (*second revision*)
1196-1978 Code of practice for laying bitumen mastic flooring (*second revision*)
1197-1970 Code of practice for laying of rubber floors (*first revision*)
1198-1958 Code of practice for laying and maintenance of linoleum floors
1237-1980 Cement concrete flooring tiles (*first revision*)
1443-1972 Code of practice for laying and finishing of cement concrete flooring tiles (*first revision*)
1542-1977 Sand for plaster (*first revision*)
1630-1960 Mason's tools for plaster work and pointing work
1661-1972 Code of practice for application of cement and cement lime plaster finishes (*first revision*)
2114-1962 Code of practice for laying *in-situ* terrazzo floor finish
2394-1965 Code of practice for application of lime plaster finish
2402-1963 Code of practice for external rendered finish
2571-1970 Code of practice for laying *in-situ* cement concrete flooring (*first revision*)
3461-1966 PVC (vinyl) asbestos floor tiles
3462-1980 Flexible PVC flooring (*first revision*)
3463-1966 Polystyrene wall tiles
3464-1966 Methods of test for plastic flooring and wall tiles
4112-1967 Code of practice for fixing of polystyrene wall tiles
4441-1980 Code of practice for use of silicate type chemical resistant mortars (*first revision*)
4442-1980 Code of practice for use of sulphur type chemical resistant mortars (*first revision*)
4456 Methods of test for chemical resistant mortars:
(Part I)-1967 Part I Silicate type and resin type
(Part II)-1967 Part II Sulphur type
4457-1967 Ceramic unglazed vitreous acid-resistant tiles
4631-1968 Code of practice for laying of epoxy resin floor toppings
4832 Chemical resistant mortars:
(Part I)-1969 Part I Silicate type
(Part II)-1969 Part II Resin type
(Part III)-1968 Part III Sulphur type
4860-1968 Acid-resistant bricks
4971-1968 Recommendations for selection of industrial floor finishes
5317-1969 Bitumen mastic for bridge decking and roads
5318-1969 Code of practice for laying of flexible PVC sheets and tile flooring
5491-1969 Code of practice for laying *in-situ* granolithic concrete floor topping
5766-1970 Code of practice for laying burnt clay brick flooring
6278-1971 Code of practice for white-washing and colour washing
7956-1975 Recommendations for selection of dairy floor finishes
8374-1977 Bitumen mastic, anti-static and electrically conducting grade
9162-1979 Method of test for epoxy resins, hardeners and epoxy resin compositions for floor topping
9197-1979 Epoxy resin, hardeners and epoxy resin compositions for floor topping

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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